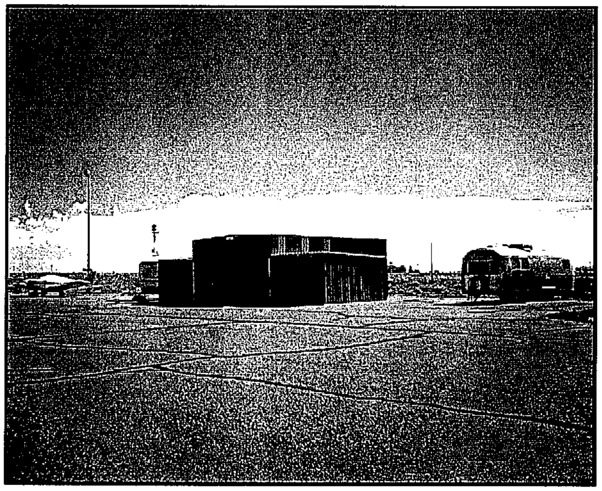
Chapter Three
AVIATION FACILITY REQUIREMENTS

Chapter Three

MUNICIPAL AIRPORT

AVIATION FACILITY REQUIREMENTS



To properly plan for the future of Holbrook Municipal Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts conducted in Chapter Two, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting), and landside (i.e., hangars and aircraft parking aprons) facility requirements.

The objective of this analysis is to identify, in general terms, the adequacy of the existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in Chapter Four to determine the most cost-effective and efficient means for implementation.

Recognizing that the need to develop facilities is determined by demand, rather than a point in time, the requirements for new facilities have been expressed for the short, intermediate, and long term planning horizons, which roughly correlate to five-year, ten-year, and twenty-year time frames. Future facility needs will be related to these activity levels rather than a specific year. **Table 3A** summarizes the activity levels that define the planning horizons used in the remainder of this master plan.

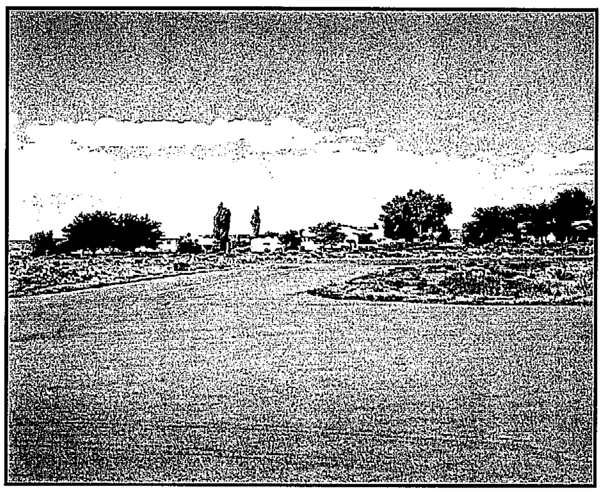


TABLE 3A Planning Horizon Activity Levels				
	Existing	Short Term	Intermediate Term	Long Term
Based Aircraft Annual Operations	14[1] 5,200[2]	18 6,800	22 9,000	30 14,100
[1]1998 [2]1997 (est.)				

AIRFIELD REQUIREMENTS

Airfield requirements include the need for those facilities related to the arrival and departure of aircraft. These facilities comprise the following items:

- Runways
- Taxiways
- Navigational Aids
- Airfield Marking and Lighting

AIRFIELD CAPACITY

A demand/capacity analysis measures the capacity of the airfield facilities (i.e., runways and taxiways) in order to identify a plan for additional development needs. The capacity of the airfield is affected by several factors including airfield layout, meteorological conditions, aircraft mix, runway use, aircraft arrivals, aircraft touch-and-go operations, and exit and entrance taxiway locations. An airport's airfield capacity is expressed in terms of its annual service volume. Annual service volume is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year.

Pursuant to FAA guidelines detailed in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, the annual service volume of an intersecting runway configuration similar to that of Holbrook Municipal Airport normally exceeds 230,000 operations. Since the forecasts for the airport indicate that the activity throughout the planning period may only reach 14,100 annual operations, the capacity of the existing airfield system will not be reached and the airfield can meet operational demands.

RUNWAY ORIENTATION

The airport is presently served by primary Runway 3-21 (oriented in a northwest-southwest direction) and a crosswind Runway 11-29 (oriented in a east-west direction). For the operational safety of an airport, the primary runway should be oriented as close as possible to the direction of the prevailing wind. This reduces the percentage of time that crosswind conditions could make the primary runway inoperable and unsafe for aircraft landing and taking off.

FAA design standards specify that a crosswind runway should be made available when the primary runway orientation provides less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots for small aircraft weighing less than 12,500 pounds and from 13 to 20 knots for aircraft weighing more than 12,500 pounds.

Runway 3-21 serves as the primary runway at Holbrook Municipal Airport. **Exhibit 3A** illustrates the wind rose for Holbrook Municipal Airport. **Table 3B** summarizes wind coverage for this runway using the most current ten years of wind data from Winslow-Lindbergh Regional Airport. As evidenced in **Table 3B**, Runway 3-21 provides greater than 95 percent wind coverage only at crosswind components greater than 13 knots (15 mph). Therefore, an additional runway orientation is required to provide sufficient crosswind coverage for 10.5 knots (12 mph).

TABLE 3B
Runway 3-21 Wind Coverage (percent)

10.5 Knots (12 mph)	13 Knots (15 mph)	16 Knots (18 mph)	20 Knots (23 mph)
94.77	97.20	99.08	99.76

Source for wind data: National Climatic Data Center, Winslow-Lindbergh Regional Airport (1988-1998)

A wind analysis was conducted for the previous Master Plan to determine the optimal runway orientations for the airport. This analysis, using wind data from Winslow-Lindbergh Regional Airport (covering the period from 1949 to 1954), similarly concluded that Runway 3-21 could not provide the minimum FAA wind coverage and recommended constructing a paved crosswind at 110.48 degrees true north (Runway 10-28) to replace the existing crosswind runway, Runway 11-29.

Table 3C summarizes wind coverage for Runway 3-21 at 10.5 knots by month using the most current ten years of wind data. As show in the table, Runway 3-21 exceeds the specified 95 percent wind coverage for all months except February, March, April, May, June, and August, which corresponds with observations made by aircraft operators at Holbrook Municipal Airport.

Using the same wind data, an analysis was conducted to determine the best combination of runway orientations for operations during the specific months when Runway 3-21 provides less than 95 percent wind coverage. As shown in **Table 3C**, the combination of Runways 3-21 and 11-29 provides slightly better wind coverage than the previously recommended combination of Runways 3-21 and 10-28 during those specific months when Runway 3-21 provides less than the specified 95 percent wind coverage. The alternatives analysis will examine options for developing a crosswind runway following the existing Runway 11-29 alignment instead of the previously recommended alignment. A local wind study may be considered prior to construction to verify the wind observations used in this analysis.

TABLE 3C
Runway Wind Coverage (10.5 Knot Crosswind)

	WIND COVERAGE		
Month	**3-21**	**3-21 and 11-29**	**3-21 and 10-28**
January	96.17	99.07	98.73
February	**93.91**	**98.20**	**97.82**
March	**92.62**	**97.67**	**97.60**
April	**91.84**	**97.20**	**97.12**
May	**93.20**	**98.07**	**98.17**
June	95.34	98.64	96.45
July	**93.45**	**98.88**	**98.82**
August	**94.91**	**99.20**	**99.08**
September	96.21	98.99	99.05
October	96.91	99.24	99.09
November	96.02	99.20	99.09
December	96.03	99.14	98.99

Source: National Climatic Data Center, Winslow-Lindbergh Regional Airport (1988-1998)

PHYSICAL PLANNING CRITERIA

The selection of the appropriate FAA design standards for the development of the airfield facilities is based primarily upon the characteristics of the aircraft which are expected to use the airport.

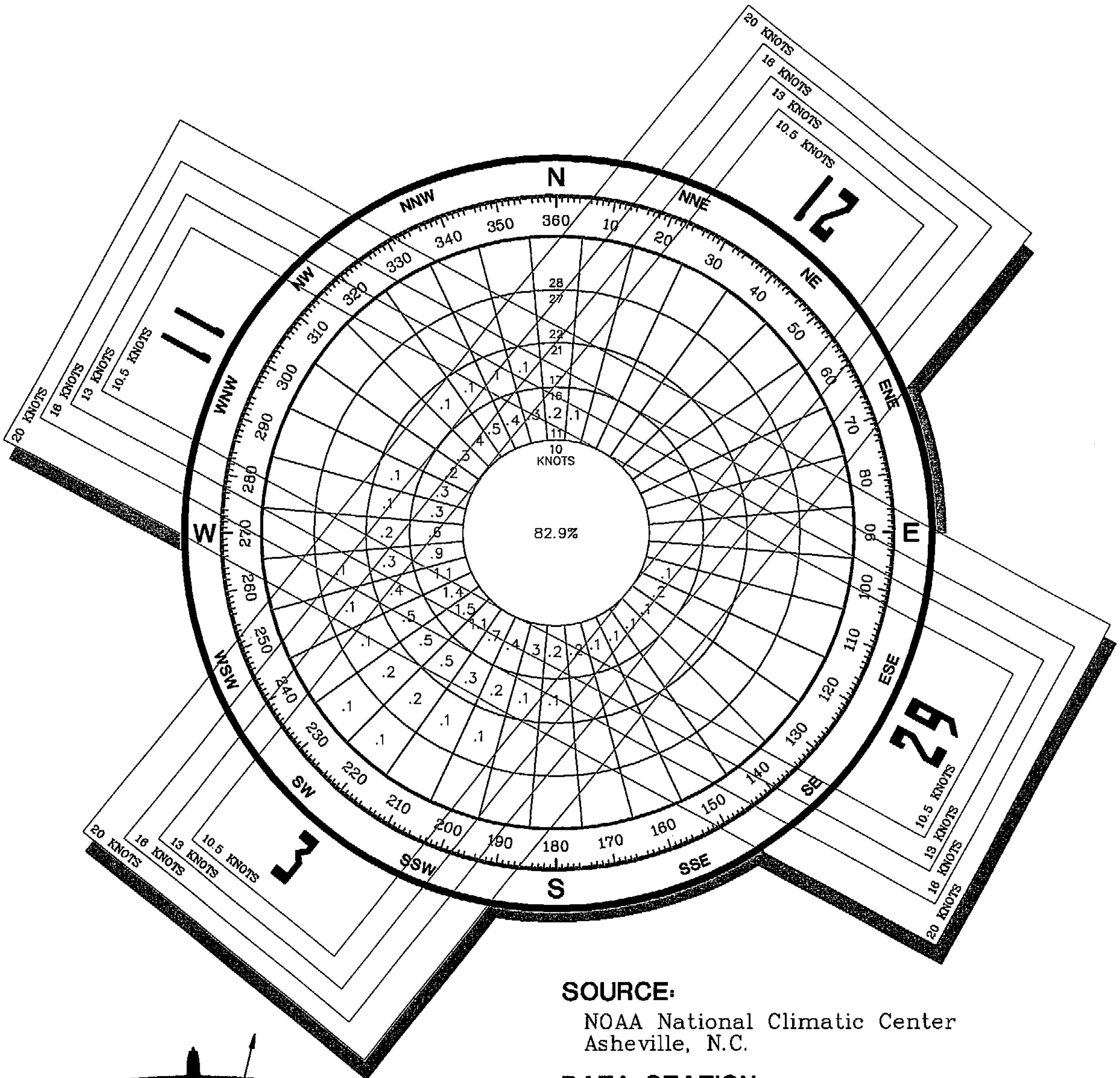
The most critical characteristics are the approach speed and the wingspan of the critical design aircraft anticipated to use the airport now or in the future. The critical design aircraft is defined as the most demanding category of aircraft that accounts for 500 or more operations per year. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These standards must be determined now since the relocation of these facilities will likely be extremely expensive at a later date.

The Federal Aviation Administration has established criteria for use in the sizing and design of airfield facilities. These standards include criteria which relate to aircraft size and performance. According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

Category A: Speeds of less than 91 knots.
Category B: Speeds of 91 knots or more, but less than 121 knots.
Category C: Speeds of 121 knots or more, but less than 141 knots.
Category D: Speeds of 141 knots or more, but less than 166 knots.

98MP10-3A-7/24/00

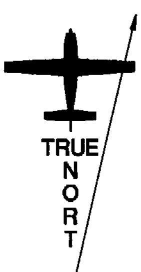
WIND COVERAGE	12 MPH 10.5 Knots	15 MPH 13 Knots	18 MPH 16 Knots	23 MPH 20 Knots
Runway 3-21	*94.77%*	*97.20%*	*99.08%*	*99.76%*
Runway 11-29	*89.54%*	*93.31%*	*96.79%*	*98.73%*
Runways Combined	*98.65%*	*99.62%*	*99.92%*	*99.99%*



SOURCE:
NOAA National Climatic Center
Asheville, N.C.

DATA STATION:
Winslow-Lindbergh Regional Airport
Winslow, Arizona

OBSERVATIONS:
72,374 Observations
Period: 1988-1997



12.083° East (April 2000)
0.7116° Annual Rate of Change

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Exhibit 3A
EXISTING WIND COVERAGE

Category E: Speeds of 166 knots or greater.

The second basic design criterion relates to aircraft size. The Airplane Design Group **(ADG)** is based upon wingspan. The six groups are as follows:

Group I: Up to but not including 49 feet.
Group II: 49 feet up to but not including 79 feet.
Group III: 79 feet up to but not including 118 feet.
Group IV: 118 feet up to but not including 171 feet.
Group V: 171 feet up to but not including 214 feet.
Group VI: 214 feet or greater.

Together, approach category and ADG identify a coding system whereby airport design criteria are related to the operational and physical characteristics of the aircraft intended to operate at the airport. This code, the Airport Reference Code (ARC), has two components: the first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways safety areas and obstruction clearance requirements, while airplane wingspan primarily relates to separation criteria involving taxiways and taxilanes. **Table 3D** provides a listing of typical aircraft and their associated ARC.

FAA advises designing all elements to meet the requirements of the airport's most demanding aircraft, or critical aircraft. As discussed above, this is the aircraft, or group of aircraft, with at least 500 annual operations at the airport. In order to determine future facility needs, an ARC should first be determined, then appropriate airport design criteria can be applied. This begins with a review of the type of aircraft currently utilizing the airport and those expected to use the airport through the planning period.

Holbrook Municipal Airport is currently utilized by all types of general aviation aircraft ranging from small single-engine piston aircraft to the occasional turboprop and business jet aircraft. All based aircraft currently fall within ARC A-I and include various single-engine piston aircraft. Regular transient users include both single-engine and multi-engine piston aircraft such as the Piper Lance (A-I), Piper Navajo (B-I), and Cessna 310 (B-I) providing daily (weekday) cargo service. A Cessna Citation Jet (B-I) and Beechcraft King Air (B-I) are operated on a quarterly basis by Arizona Public Service (APS).

Based on existing operational activity, the current critical aircraft fall within ARC B-I and include a range of piston, turboprop, and jet aircraft. As discussed previously in Chapter Two, Aviation Demand Forecasts, Holbrook Municipal Airport can expect to serve a growing number of operations by more sophisticated general aviation aircraft, particularly business and corporate turboprop and jet aircraft through the planning period. Examples of aircraft which may utilize the airport on an increasing basis include the Cessna and Dassault Falcon business jet families (ARCs B-I and B-II) and Beechcraft Super King Air (ARC B-II). Therefore, as activity grows as the airport, the airport can expect an increase in operations by aircraft within ARC B-II.

TABLE 3D
Representative General Aviation Aircraft by Airport Reference Code

Airport Reference Code	Typical Aircraft	Approach Speed (knots)	Wingspan (feet)	Maximum Takeoff Weight (lbs.)
	Single-Engine Piston			
A-I	Cessna 150	55	32.7	1,600
A-I	Cessna 172	64	35.8	2,300
A-I	Beechcraft Bonanza	75	37.8	3,850
	Turboprop			
A-II	Cessna Caravan	70	52.1	8,000
	Multi-Engine Piston			
B-I	Beechcraft Baron 58	96	37.8	5,500
B-I	Piper Navajo	100	40.7	6,200
B-I	Cessna 421	96	41.7	7,450
	Turboprop			
B-I	Mitsubishi MU-2	119	39.2	10,800
B-I	Piper Cheyenne	119	47.7	12,050
B-I	Beechcraft King Air B-100	111	45.8	11,800
	Business Jets			
B-I	Cessna Citation I	108	47.1	11,850
B-I	Falcon 10	104	42.9	18,740
	Turboprop			
B-II	Beechcraft Super King Air	103	54.5	12,500
B-II	Cessna 441	100	49.3	9,925
	Business Jets			
B-II	Cessna Citation II	108	51.7	13,330
B-II	Cessna Citation III	114	53.5	22,000
B-II	Cessna Citation Bravo	114	52.2	15,000
B-II	Cessna Citation Excel	114	55.7	19,400
B-II	Cessna Citation Ultra	109	52.2	16,500
B-II	Falcon 20	107	53.5	28,660
B-II	Falcon 900	100	63.4	45,500
	Business Jets			
C-I	Learjet 55	128	43.7	21,500
C-I	Rockwell Sabre 75A	137	44.5	23,300
C-I	Learjet 25	137	35.6	15,000
	Turboprop			
C-II	Rockwell 980	121	52.1	10,325
	Business Jets			
C-II	Canadair Challenger	125	61.8	41,250
C-II	Gulfstream III	136	77.8	68,700
	Business Jets			
D-I	Learjet 35	143	39.5	18,300
D-II	Gulfstream II	141	68.8	65,300
D-II	Gulfstream IV	145	78.8	71,780

As the primary runway, Runway 3-21 should be designed to accommodate the critical design aircraft. Therefore, Runway 3-21 should follow ARC B-II design standards. As detailed in the runway orientation analysis, a crosswind runway is needed to primarily serve small aircraft less than 12,500 pounds. According to FAA design standards, the crosswind runway is expected to serve small aircraft through ARC B-I. Therefore, ARC B-I design standards for small aircraft are appropriate for the design of a paved crosswind runway.

The design of taxiway and apron areas should consider the wingspan requirements of the most demanding aircraft to operate within that specific functional area on the airport. The transient apron and large conventional hangar areas should follow ADG II standards to accommodate the full range of turboprop and business jet aircraft expected to use the airport through the planning period. ADG I standards can be applied to future T-hangar and local aircraft tiedown areas.

AIRFIELD DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions that could affect the safe operation of aircraft. These include the object free area (OFA), obstacle free zone (OFZ), runway safety area (RSA), and runway protection zones (RPZ).

The OFA is defined as a "two dimensional ground area surrounding runways, taxiways, and taxilanes which are clear of objects except for objects whose location is fixed by function." The RSA is defined as "a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or an excursion from the runway." An obstacle free zone is a volume of airspace that is required to be clear of objects, except for frangible items required for navigation of aircraft. It is centered along the runway and extended runway centerline. The RPZ is defined as an area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The dimensions of an RPZ are a function of the runway ARC and approach visibility minimums.

Table 3E summarizes the design requirements of these safety areas by airport reference code for Holbrook Municipal Airport. The FAA expects these areas to be under the control of the airport and free from obstructions.

B-I (small aircraft exclusively) design standards apply to both the existing and future crosswind runway. B-II standards apply to the ultimate design and operation of Runway 3-21. A review of current airport drawings indicates that the existing segmented circle and lighted wind cone fall within the ultimate (ARC B-II) OFZ and OFA. Additionally, the existing and ultimate Runway 3 RPZ falls outside the existing property line, and the RPZ at each end of Runway 11-29 falls outside the existing airport property line. A number of existing buildings are also located within the Runway 29 RPZ. Previous planning included constructing a crosswind runway further north to provide for clear approaches to each runway end.

TABLE 3E
Airfield Safety Area Dimensional Standards

	B-I Small Aircraft Only Visual Approaches	B-I Visual Approaches	B-II One Mile Visibility Approach Minimums
Runway Safety Area			
Width	120	120	150
Length Beyond Runway End	240	240	300
Object Free Area Width	250	400	500
Length Beyond Runway End	240	240	300
Runway Protection Zone			
Inner Width	250	500	500
Outer Width	450	700	700
Length	1,000	1,000	1,000

Source: FAA Airport Design Computer Program Version 4.2D

RUNWAY LENGTH

The determinations of runway length requirements for the airport are based on five primary factors. These include the critical aircraft type expected to use the airport, mean maximum daily temperature of the hottest month, runway gradient, and airport elevation. Aircraft performance declines as each of these factors increase.

For Holbrook Municipal Airport, the airport elevation is 5,257 feet above mean sea level (MSL) and the mean maximum temperature of the hottest month (July) is 94 degrees Fahrenheit. The effective runway gradient for Runway 3-21 is 0.4 percent. Runway gradient is the difference in elevation at each end of the runway divided by the length of the runway. For calculating runway length requirements at Holbrook Municipal Airport summertime temperatures and the airfield elevation are the primary factors in determining runway length requirements.

Using the data specific to Holbrook Municipal Airport, runway length requirements for the various classifications of aircraft that may operate at the airport were examined using the FAA Airport Design computer program Version 4.2D. This program groups general aviation aircraft into several categories, reflecting the percentage of the fleet within each category and useful load of the aircraft. **Table 3F** summarizes FAA recommended runway lengths for Holbrook Municipal Airport.

Based upon the existing aircraft fleet mix operating at Holbrook Municipal

Airport and the projected aircraft fleet mix through the long term planning period, Runway 3-21 should be designed to accommodate aircraft through ARC B-II. The appropriate FAA runway length planning category for aircraft within ARC B-II is "small airplanes with 10 or more passenger seats." At its present length of 6,698 feet, Runway 3-21 falls 102 feet short of meeting this minimum FAA planning criteria. As discussed previously, a crosswind runway is expected to serve small aircraft within ARC B-I. The appropriate FAA runway length planning for ARC B-I (small aircraft exclusively) is "75 percent of small aircraft with less than 10 passenger seats." As shown in **Table 3F**, the FAA recommends a 4,900-foot long runway for small aircraft within ARC B-I.

TABLE 3F
FAA Recommended Runway Length Requirements

AIRPORT AND RUNWAY DATA	
Airport elevation	5,257 feet
Mean daily maximum temperature of the hottest month	94.4 F
Maximum difference in runway centerline elevation (Runway 3-21)	7 feet
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	4,900 feet
95 percent of these small airplanes	6,700 feet
100 percent of these small airplanes	6,800 feet
Small airplanes with 10 or more passenger seats	6,800 feet
Large airplanes of 60,000 pounds or less	
75 percent of these large airplanes at 60 percent useful load	7,100 feet
75 percent of these large airplanes at 90 percent useful load	8,700 feet

Small airplanes - aircraft less than 12,500 pounds
Source: FAA Airport Design computer program version 4.2D

RUNWAY WIDTH

Runway width is primarily determined by the planning ARC for a particular runway. As mentioned previously, a B-II ARC is appropriate for Runway 3-21 through the planning period. At 75 feet wide, Runway 3-21 meets B-II design criteria. A future paved crosswind runway should be constructed with a pavement width of 60 feet to conform with ARC B-I design standards for small aircraft.

RUNWAY PAVEMENT STRENGTH

The most important feature of airfield pavement is its ability to withstand repeated use by aircraft of significant weight. Presently, Runway 3-21 has a pavement strength of 12,000 pounds single wheel loading (SWL). This strength rating is sufficient only for small general aviation piston driven aircraft and limited turboprop aircraft. While the runway can accommodate limited operations by heavier aircraft, a pavement load bearing strength of 30,000pounds SWL is needed to accommodate the expected fleet mix through the planning period. A future crosswind runway will need to be stressed to 12,500 pounds SWL to accommodate the mix of small aircraft expected to use this runway.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

Runway 3-21 is served by a full length parallel taxiway 35 foot wide located approximately 200 feet south of the Runway 3-21 centerline. Design standards for the separation distances between runways and taxiways are based primarily on the planning ARC for each runway. For Runway 3-21, ARC B-II design standards specify a runway /taxiway separation distance of 240 feet. The alternatives analysis will examine options for conforming with this standard. For a future paved crosswind runway, ARC B-I (small aircraft exclusively) design standards specify a runway/taxiway separation width of 150 feet.

Taxiway width is primarily determined by the Airplane Design Group (ADG) of the most demanding aircraft to use the taxiway. ADG II has been designated for the taxiways serving Runway 3-21. ADG II specifies a taxiway width of 35 feet. Presently, taxiways A4, A6, and B exceed this minimum standard. Taxiway A is only 25 feet wide and does not meet ADG II standards. Taxiways for a paved crosswind runway should follow ADG I standards which require a taxiway width of 25 feet.

Holding aprons provide an area at the runway end for aircraft to prepare for departure and/or bypass other aircraft which are ready for departure. Holding aprons should be planned for all runway ends.

NAVIGATIONAL AIDS AND INSTRUMENT APPROACH PROCEDURES

Electronic navigational aids are used by aircraft enroute to the airport and during an approach to landing at the airport. For Holbrook Municipal Airport, pilots can use the Winslow very-high frequency omnidirectional range (VOR) facility, Show Low nondirectional beacon (NDB), Loran-C and Global Positioning System (GPS) navigational aids for enroute course guidance assistance to the airport.

Instrument approach procedures are a series of maneuvers designed by the FAA which utilize navigational aids and assist pilots in locating and landing at an airport and are especially helpful during poor weather conditions. The VOR, NDB, and GPS navigational aids are commonly used for instrument approach procedures.

Presently, Holbrook Municipal Airport is not served by an instrument approach. Therefore, the airport is effectively closed during poor weather conditions when visual flight can no longer be conducted. The increased use of general aviation aircraft for business and corporate uses has advanced the need for approaches at non-commercial airports. With the need for the airport to support and enhance business and industrial growth in the City of Holbrook, it is important that the airport is accessible during all weather conditions and the amount of time that the airport is inaccessible due to inclement weather is reduced. Aircraft operating under Federal Aviation Regulations (F.A.R.) Part 135, conducting aircraft charter activities, are primarily affected as these aircraft cannot land at an airport during low visibility and cloud ceiling conditions without an approved instrument approach procedure. Therefore, facility planning should include establishing instrument approaches at the airport so that the airport is accessible during poor weather conditions.

The advent of Global Positioning System (GPS) technology will ultimately provide the airport with the capability of establishing instrument approaches. As mentioned previously in Chapter One, the FAA is proceeding with a program to transition from existing ground-based navigational aids to a satellite-based navigation system utilizing GPS technology. GPS is currently certified for enroute guidance and for use with instrument approach procedures. The initial GPS approaches being developed by the FAA provide only course guidance information. By the year 2003, it is expected that GPS approaches will also be certified for use in providing descent information for an instrument approach. Currently, this capability is only available using an Instrument Landing System.

GPS approaches fit into three categories, each based upon the desired visibility minimum of the approach. The three categories of GPS approaches are: one-half mile, three-quarter mile, and one mile. To be eligible for a GPS approach, the airport landing surface must meet specific standards as outlined in Appendix 16 of the FAA airport design advisory circular. The specific airport landing surface requirements which must be met in order to establish a GPS approach and a comparison of these standards to existing airport facilities are summarized in **Table 3G**.

As evidenced in the table, the existing airport site can support a GPS approach with one mile visibility minimums. For lower GPS approach minimums, the airport would need to invest in additional approach lighting systems and upgrade existing runway markings.

According to regional weather observations, visual weather conditions occur nearly 99 percent of the time. Therefore, it would appear that only limited instrument approach capability is needed at the airport as weather conditions seldom fall below visual conditions. Based upon the prevailing weather conditions and the costs associated with installing and maintaining approach lighting systems, it would appear unnecessary to plan for GPS approaches with visibility minimums lower than one-mile.

TABLE 3G
GPS Instrument Approach Requirements

Requirement	One-Half Mile Visibility	¾ Mile Visibility Greater Than 300-Foot Ceiling	One Mile Visibility Greater Than 400-Foot Ceiling	Existing (Runway 3-21)
Minimum Runway Length	4,200 Feet	3,500 Feet	2,400 Feet	6,740 Feet
Runway Markings	Precision	Nonprecision	Visual	Basic
Runway Edge Lighting	Medium Intensity	Medium Intensity	Low Intensity	Medium Intensity
Approach Lighting	MALSR	SSALS	Not Required	None

Source: Appendix 16, FAA AC 150/5300-13, *Airport Design*, Change 5
MALSR - Medium intensity approach lighting system with runway alignment lighting
SSALS - Simplified short approach lighting system

A NAVAIDS study completed by ADOT reached similar conclusions and plans for a one-mile visibility minimum GPS approach to Runway 21. Facility planning should include providing a similar GPS approach to Runway 3. No instrument approach capability is needed for a paved crosswind runway since this runway is expected to primarily serve small aircraft during visual conditions.

LIGHTING AND MARKING

Currently, there are a number of lighting and pavement marking aids serving pilots using Holbrook Municipal Airport. These lighting systems and marking aids assist pilots in locating the airport during night or poor weather conditions and assisting in the ground movement of aircraft.

Pavement Markings

Runway markings are designed according to the type of instrument approach available on the runway. FAA AC 150/5340-1F, *Marking of Paved Areas on Airports*, provides the guidance necessary to design an airport's markings. Runway 3-21 is equipped with basic markings which identify the runway centerline and designation. According to **Table 3G**, these markings are sufficient for the planned GPS approaches to Runways 3 and 21. Basic markings are sufficient for the planned visual approaches to the crosswind runway.

Taxiways and apron areas also require markings to assure that aircraft remain on the pavement. Yellow centerline stripes are painted on all taxiway and apron surfaces at the airport to provide this guidance to pilots. Besides routine maintenance, these markings will be sufficient through the planning period.

Airfield Lighting

Airport lighting systems provide critical guidance to pilots during nighttime and low visibility operations. Runway 3-21 is equipped with medium intensity runway lights (MIRL). These systems are sufficient for any future GPS approaches and should be maintained through the planning period. Facility planning should include MIRL for a future paved crosswind runway.

Effective ground movement of aircraft at night is enhanced by the availability of taxiway lighting. Presently, medium intensity taxiway lighting (MITL) is in place along all taxiways. This lighting is sufficient and should be maintained through the planning period. Taxiways serving a future paved crosswind runway should be equipped with MITL.

The airport is equipped with a rotating beacon to assist pilots in locating the airport at night. The existing rotating beacon is adequate and should be maintained in the future. The airport has a lighted wind cone and segmented circle which provides pilots with information about wind conditions and local traffic patterns. Each of these facilities should be maintained through the planning period. Consideration should be given to relocating the segmented circle and lighted wind cone outside of the Runway 3-21 OFZ and OFA.

Visual Approach Lighting

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, visual glideslope indicators (VGSIs) are commonly provided at airports. The type of VGSIs available at the airport are visual approach slope indicators (VASIs) which are installed at each end of Runway 3-21. Facility planning should include installing a similar system at each end of a future paved crosswind runway.

Runway end identifier lights (REIL) provide rapid and positive identification of the approach end of the runway. REILs are presently installed at each end of Runway 3-21. These lighting aids are sufficient and should be maintained through the planning period.

Weather Observation Systems

Presently, the airport is without any form of automated or actual weather observation which provide important weather details to pilots such as visibility, cloud ceilings, and altimeter settings. Wind speed and direction can be estimated by pilots using the lighted wind cone.

The unavailability of current weather observation and reporting primarily affects itinerant aircraft operations to the airport as pilots cannot readily determine weather conditions at Holbrook Municipal Airport from a distant airport. The nearest weather reporting station is located at Winslow-Lindbergh Regional Airport approximately 30 nautical miles to the west. Aircraft operating under Federal Aviation Regulations (F.A.R.) Part 135, conducting aircraft charter and commercial activities, are especially affected as these aircraft cannot operate at the airport unless current weather reporting is available.

To provide weather observations and reporting, an automated weather observation system (AWOS) is commonly installed at an airport. In general, there are three AWOS systems, each with varying capabilities. An AWOS-I processes and outputs temperature, dewpoint, barometric pressure, density altitude (airfield elevation adjusted for temperature), wind speed, wind direction, and wind gusts. An AWOS-II provides visibility data in addition to the parameters listed above for an AWOS-I. An AWOS-III provides cloud ceiling and condition reporting in addition to the other parameters listed above. All AWOS systems record and update weather observations every minute, 24 hours a day.

Facility planning should include installing an AWOS at Holbrook Municipal Airport to provide critical weather information for local and transient pilots.

Helipad

The most critical helicopter presently operating at the airport is the Bell Jet Ranger. Based on planning and design standards, the existing helipad can safely accommodate this helicopter. Therefore there is not a need to increase the size of the helipad. Facility planning should include installing edge lighting on the helipad for easier identification of the helipad at night and in poor weather conditions. Proper markings on the helipad should be maintained through the planning period.

AIRFIELD CONCLUSIONS

A summary of the airfield facility requirements is presented on **Exhibit 3B**. Consistent with previous master plans, facility planning should include constructing a paved crosswind runway (4,900 feet long by 60 feet wide) to serve small aircraft during strong crosswind situations. This runway is best oriented at 118.50 degrees true north to accommodate prevailing wind conditions during the early spring and late summer months. To enhance airfield capacity and aircraft safety, the paved crosswind runway should be served by a full length parallel taxiway and ultimately be equipped with a visual glideslope indicator (VGSI) system at each runway end and a medium intensity runway and taxiway lighting system. Ultimately, a GPS approach should be established to each end of Runway 21, to provide for aircraft arrivals during low visibility and cloud ceiling conditions.

To provide for night operations to the helipad, the helipad should ultimately be equipped with perimeter edge lighting. An AWOS would enable local and transient pilots to determine weather conditions at the airport and provide for on-demand aircraft charter

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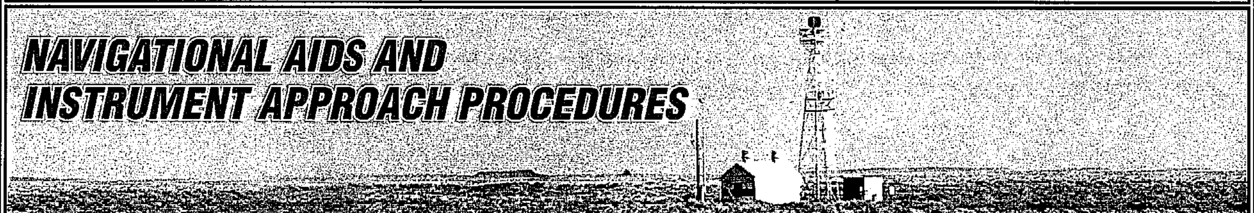
EXISTING	SHORT TERM NEED (0-5 Years)	LONG TERM NEED (5-20 Years)
Runway 3-21 6,698' x 75' • 12,000 SWL Full Length Parallel Taxiway A 6 Entrance/Exit Taxiways	**Runway 3-21** Increase Pavement Strength to 30,000 lbs. Extend to 6,800'	**Runway 3-21** Increase Runway/Taxiway Separation Distance Acquire Property to Protect RPZ
Crosswind Runway (11-29) 3,200' x 120' Turf	**Crosswind Runway** Paved 4,900' x 60' Oriented 118.50° True North 12,500 lbs. SWL Full-Length Parallel Taxiway 25' Wide	**Crosswind Runway** Same



EXISTING	SHORT TERM NEED (0-5 Years)	LONG TERM NEED (5-20 Years)
None	AWOS GPS Approach to Runway 21	Same GPS Approach to Runway 3

EXISTING	SHORT TERM NEED (0-5 Years)	LONG TERM NEED (5-20 Years)
Rotating Beacon Segmented Circle/Lighted Wind Cone	Same Relocate outside OFA/OFZ	Same Same
VASI (3-21) REIL (3-21) MIRL (3-21) MITL (3-21)	Same Same VGSI (Crosswind Runway) MIRL (Crosswind Runway) MITL (Crosswind Runway)	Same Same Same Same Same
Basic Runway Markings Runway (3-21)	Same Basic Runway Markings Crosswind Runway	Same Same

VOR - Very High Frequency Omnidirectional Range Facility
REIL - Runway End Identifier Light
MIRL - Medium Intensity Runway Lights
AWOS - Automated Weather Observation System
VASI - Visual Approach Slope Indicator
VGSI - Visual Glideslope Indicator
MITL - Medium Intensity Taxiway Lights

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Exhibit 3B
AIRFIELD FACILITY REQUIREMENTS

operations to the airport during inclement weather conditions (provided instrument approach capability is established).

The critical design aircraft for Runway 3-21 presently falls withing ARC B-I. In the future, the critical design aircraft are expected to fall within ARC B-II. While meeting or exceeding many design requirements for existing and future critical design aircraft, Runway 3-21 does not fully meet OFA, OFZ, RPZ, and runway /taxiway separation standards for ARC B-II. The alternatives analysis will examine the options available for meeting these design requirements.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling of aircraft, passengers, and freight while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacities of the various components of each area were examined in relation to projected demand to identify future landside facility needs.

HANGAR, APRON, AND TERMINAL REQUIREMENTS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is in more sophisticated (and consequently more expensive) aircraft. Therefore, many hangar owners prefer enclosed hangar space to outside tie-downs. Presently, based aircraft are stored in enclosed hangar facilities.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based on actual demand trends and financial investment conditions. Although all based aircraft are presently stored in enclosed hangar facilities, it is assumed that a small portion of future based aircraft will tiedown outside (due to lack of hangar availability, hangar rental rates, or operational needs) and that approximately 90 percent of total based aircraft will desire enclosed hangar facilities.

Future hangar requirements for the airport are summarized in **Table 3H** and on **Exhibit 3C**. A planning standard of 1,200 square feet per based aircraft stored in T-hangars has been used to determine future T-hangar requirements. A planning standard of 2,500 square feet for large aircraft stored in conventional hangars has been used to determine future conventional hangar requirements. Conventional hangar area was increased by 15 percent to account for future aircraft maintenance needs.

Presently, aircraft storage and maintenance and repair needs are being met through the use of a large clearspan (conventional) hangar and enclosed T-hangar and Port-A-Port hangars. A trend in hangar development is for the construction of smaller clearspan hangars instead of traditional T-hangar facilities. Smaller clearspan hangars have the ability to accommodate multiple aircraft simultaneously and larger business jet and turboprop aircraft. In the future, it is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. While a specific requirement for smaller clearspan hangars has not been made, facility planning should include providing an area for individuals and/or businesses to construct their own hangar. The alternatives analysis will examine the options available for hangar development at the airport and determine the best location for each type of hangar facility. For planning purposes, T-shade hangars are included with T-hangar requirements since T-shade hangars are similar in size to typical T-hangars.

TABLE 3H
Aircraft Storage Hangar Requirements

		Future Requirements		
	Available	Short Term	Intermediate Term	Long Term
Aircraft to be Hangared		16	20	28
T-Hangar Positions	11	12	14	18
Conventional Hangar Positions	3-6	4	6	10
Conventional Hangar Area (s.f.)	7,500	12,500	18,300	29,800
T-Hangar Area (s.f.)	11,200	14,400	16,800	21,600
Total Hangar Area (s.f.)	18,700	26,900	35,100	51,400

Aircraft Parking Apron

Aircraft parking apron requirements are primarily determined by examining locally-based and transient aircraft parking apron requirements. Presently, approximately 40 aircraft tiedown positions are available for both transient and locally-based aircraft on the existing 21,500 square yard parking apron at the airport.

Existing airport records indicate that all based aircraft are currently stored in enclosed hangar facilities at the airport. In the future, it is assumed that a small number of locally-based aircraft will tiedown outside (approximately 10 percent of total based aircraft) and will be a function of available hangar space and hangar rental rates. Transient aircraft parking apron positions are estimated as a percentage of forecast busy day operations. For Holbrook Municipal Airport, the future number of transient aircraft parking positions was determined as 17.5 percent of forecast busy day operations. Total apron requirements were determined by applying a planning criterion of 800 square yards of apron for each transient aircraft parking position and 650 square yards of apron for each locally-based aircraft parking position. Transient business jet apron requirements were determined by applying a planning criterion of 1,600

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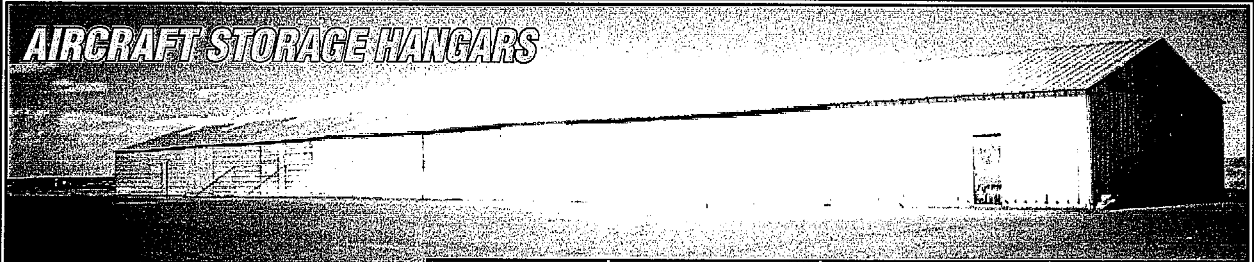
AIRCRAFT STORAGE HANGARS



	[illegible]	[illegible]	[illegible]	[illegible]
T-Hangar Positions	11	12	14	18
Conventional Hangar Positions	3-6	4	6	10
T-Hangar Area (s.f.)	11,200	12,500	18,300	29,800
Conventional Hangar Area (s.f.)	7,500	14,400	16,800	21,600
Total Hangar Area (s.f.)	18,700	26,900	35,100	51,400

APRON AREA

	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Transient Apron Positions	---	4	5	8
Transient Business Jet Positions	---	1	1	2
Locally-Based Aircraft Positions	---	2	2	2
Total Positions	40	7	8	12
Total Apron Area (s.y.)	21,500	6,100	7,000	10,900

VEHICLE PARKING

	AVAILABLE	SHORT TERM NEED	INTERMEDIATE NEED	LONG TERM NEED
Terminal Vehicle Spaces	---	7	10	17
General Aviation Spaces	---	9	11	15
Total Parking Spaces	---	16	22	32
Total Parking Area (s.f.)	---	6,600	8,300	12,900

MUNICIPAL AIRPORT

Exhibit 3C
LANDSIDE FACILITY REQUIREMENTS

square yards for each transient business jet parking position.

As evidenced in **Table 3J** and on **Exhibit 3B**, the number of existing tiedowns and available apron area appears sufficient to accommodate the forecast number of locally-based and transient aircraft through the planning period.

TABLE 3J
Aircraft Parking Apron Requirements

	Currently Available	Short Term	Intermediate Term	Long Term
Transient Aircraft				
Positions		4	5	8
Apron Area (s.y.)		3,200	4,100	6,400
Transient Business Jet Positions				
Positions		1	1	2
Apron Area (s.y.)		1,600	1,600	3,200
Locally-Based Aircraft				
Positions		2	2	2
Apron Area (s.y.)		1,300	1,300	1,300
Total Positions	40	7	8	12
Total Apron Area (s.y.)	21,500	6,100	7,000	10,900

Terminal Building

General aviation terminal facilities provide an area for transient passengers to meet waiting passengers. Additionally, general aviation terminal facilities typically provide space for a pilot's lounge and flight planning, concessions, management, storage, restrooms, and general aviation businesses providing services such as refueling and line services. Presently, terminal space attached to the large conventional hangar provides areas for these activities.

Considering the age of the hangar (built in the 1940s) and the need to provide a suitable terminal facility for transient passengers, previous planning included the development of a public terminal building at the airport. The size of the terminal building is dependent upon many factors, most importantly the type of activities to be accommodated in the terminal building. A minimum of 1,500 square-feet of terminal space is typically needed to provide an area for a waiting lobby, general aviation business and management offices, restrooms, concessions, storage, and a pilot's lounge and flight planning. Additional area will be required should services such as rental car counters and restaurant facilities be desired. Local building preferences and building code requirements will also affect the final design of the terminal.

SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airfield, terminal building, or general aviation areas have been identified. These other areas provide certain functions related to the overall operations and safety of the airport and include: airport access, vehicle parking, fuel storage, and aircraft rescue and firefighting.

Airport Access

Presently, the airport is primarily accessed via West Vista. This road provides direct access to the general aviation apron and terminal building. Airport Road (the original airport access road) provides access along the south side of the aircraft apron and helipad area. Future access road requirements will be dependent upon the location of development parcels on the airport and will be examined in the alternatives analysis.

Vehicle Parking

A paved area next to the terminal building currently provides the only designated parking areas at the airport. Access to the apron is available for based aircraft owners. While this is adequate for current use, designated paved parking areas will be needed in the future to accommodate additional aircraft owners and for parking at a future terminal site. Future parking requirements are summarized in **Table 3K**.

TABLE 3K
Vehicle Parking Requirements

		Future Requirements		
	Currently Available	**Short Term**	**Intermediate Term**	**Long Term**
Design Hour Passengers	4	6	8	13
Terminal Vehicle Spaces	4	7	10	17
Parking Area (s.f.)	1,600	3,000	3,900	6,900
General Aviation Spaces	0	9	11	15
Parking Area (s.f.)	0	3,600	4,400	6,000
Total Parking Spaces	4	16	21	32
Total Parking Area (s.f.)	1,600	6,600	8,300	12,900

Fuel Storage

A stationary fuel island (owned by the City of Holbrook), located along the west edge of the apron, provides for aircraft fueling. Fuel storage includes a single 11,750 gallon above-ground storage tank for 100LL Avgas.

According to fuel records, approximately 50,000 gallons of 100LL avgas were used in 1997. This equates to approximately 4,100 gallons in an average month, or 8.2 gallons per operation. Applying the gallons per operation to forecast operational levels equates to a storage requirement for approximately 11,000 gallons of fuel during the peak month in the long term planning horizon. The 11,750-gallon aboveground storage tank should be sufficient through the planning period.

Presently, Jet A fuel is not available at the airport. Facility planning should include the ability to provide Jet A at the airport as operations by aircraft requiring this fuel are expected to increase through the planning period. Considering the need to maintain an adequate supply of full on-hand while having the ability to receive a full tanker of fuel (8,000 gallons) for best pricing, future 100LL and Jet A fuel storage tanks should provide a minimum of 10,000 gallons of storage capability (or be similar in size to the new 100LL storage tanks).

Aircraft Owner Maintenance and Aircraft Wash Facility

Presently, a number of airports are constructing or considering the development of an aircraft owner maintenance facility to meet tougher environmental requirements for hazardous material handling and disposal. These areas typically provide for the collection of used aircraft oil and other hazardous materials and provide a covered area for aircraft washing and light maintenance. The development of a similar facility at Holbrook Municipal Airport could reduce environmental exposure to the City of Holbrook and provide an additional revenue source for the City which could be used to amortize developments costs.

Aircraft Rescue and Firefighting

Requirements for airport rescue and firefighting are specified in Federal Aviation Regulation (FAR) Part 139 and apply to airports serving air carrier aircraft with 30 or more passenger seats. Since the airport is not served by scheduled airline flights and the airport does not operate under Federal Aviation Regulation (FAR) Part 139 standards, the airport is not required to have aircraft rescue and firefighting equipment.

The City of Holbrook volunteer firefighting department responds to airfield emergencies. Firefighting equipment is located adjacent to the airport in Fire Station Three (located north of Airport Road).

Perimeter Fencing

The airport boundary along the north, east, and west sides of the airport are bordered by five-strand barbwire fencing. Chain-link fencing extends around much of the terminal area. These fenced areas will be sufficient through the planning period, however, facility planning should include installing manual or automated gates at each entrance to the airport to prevent vehicles from inadvertently accessing airfield operational areas while providing additional airfield security.

LANDSIDE CONCLUSIONS

To accommodate forecast general aviation demand, enclosed T-hangar and conventional hangar space will be required through the planning period. The number of tiedowns and available apron area is sufficient through the planning period. Additional vehicle parking areas near the terminal and hangar areas will be needed through the planning period. In addition, future planning should include an aircraft wash rack and tenant maintenance shelter. Landside facility requirements are summarized on **Exhibit 3C**.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet aviation demand projected at Holbrook Municipal Airport through the planning period. The next step is to develop a direction for development to best meet these projected needs. The remainder of the master plan will be devoted to outlining this direction, its schedule, and its costs.